August 20, 2004

MEMORANDUM TO: Catherine Haney, Program Director
Policy and Rulemaking Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

FROM: David C. Lew, Chief ***/RA/***
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SUBJECT: UPDATE OF RISK AND COST-BENEFIT CONSIDERATIONS ASSOCIATED WITH GSI-191, ASSESSMENT OF DEBRIS ACCUMULATION ON PWR SUMP PERFORMANCE

REFERENCE:" Risk and Cost-Benefit Considerations Associated with GSI-191, Assessment of Debris Accumulation on PWR Sump Performance", an attachment (See Adams Accession Number ML012750414, page 204) to the memorandum from Collins to Thadani dated September 28, 2001, and entitled "RES Proposed Recommendation for Resolution of GSI-191 . . ." (Adams Accession Number ML012750091).

This is an update of the results given in the above reference. The results in the reference have been updated to use 2004 dollars instead of 2001 dollars, discount rates of 3% and 7% are used, instead of only a 7% discount rate as in the reference, and 100% of the PWR plants are assumed to obtain a renewal of their licensees for 20 years, instead of only 85% of the PWR plants. The fixes for the sump clogging problem are assumed to be in place three years from today, in 2007, whereas in 2001 the fixes were assumed to be in place in 2004. Accordingly, a plant which renews its license will have, on the average, 31 years with the fix in place, instead of the 34 years assumed in the reference.

In the reference, three sets of plants were defined, to which the fix might be applied:

-- **25 plant case**: The first set of plants to be considered were the 25 plants which are "very likely" to have the sump screens clogged for all size loss of coolant accidents (LOCAs).

-- **31 plant case**: The second set of plants to be considered were those which are "very likely" to have the sump screen clogged for medium and large LOCAs, irrespective of their likelihood of sump screen clogging for small LOCAs. There are 31 plants in this category, including the 25 plants in the first set.

-- **37 plant case:** The third set of plants adds to the 31 plant set the plants which are "very likely" to have sump screen clogging for large LOCAs, and are "likely" to have sump screen clogging for medium LOCAs. This adds 6 plants to the 31 plant set, so that the third set contains 37 plants.

In the calculations, the terms "very likely", "likely", "possible", and "unlikely" (from the Los Alamos work) are to be identified with probabilities of sump screen clogging (to the point of ECCS recirculation failure) of 1, 0.6, 0.4, and 0, from discussions with the Los Alamos contractors in the summer of 2001.

In the reference, it was found that fixing any of the three sets was cost-effective (monetized benefits exceeds costs). My understanding (from Leslie Kerr) is that NRR will be estimating the costs of the plant modifications, so the results given here only update the monetized benefits. For the three different plant sets, and the two different discount rates assumed, the table below gives the updated monetized benefits:

Case	**Monetized Benefit**	
	7% discount rate	**3% discount rate**
25 plant case	7.58E+07	1.32E+08
31 plant case	9.20E+07	1.60E+08
37 plant case	9.86E+07	1.72E+08

Note that these calculations are only for the base case, where it is assumed that reactor coolant pump seal leaks do not have the potential to clog the sump (see the reference). In the reference, a sensitivity case was also performed where reactor coolant pump seal leaks were assumed to behave as small LOCAs.

In the attachment, more detailed results are given, including the results for various percentages of plants obtaining license renewal, from 50% to 100%. In addition, the results correct an error in the presentation of the onsite averted costs, in the reference. This error did not affect the total averted costs (that is, the total monetized benefits).

Attachment: As stated

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Attachment

The tables in this attachment give some additional results, including the averted offsite monetized costs, the averted offsite property costs, the averted onsite property costs, the averted onsite dose, and the total averted costs, as a function of the remaining average life of the plant aggregate (e.g., the 25 plant aggregate), for both a 3% and 7% discount rate. The total averted costs are given as a function of the percentage of plants obtaining license renewal, from 50% to 100%. All costs are given in year 2004 dollars.

The key to the column headings is given below:

t=	Number of years of reactor operation with the fix in place
OffHealth =	Expected Averted Monetized Offsite Health Costs
OffProp =	Expected Averted Offsite Property Costs
OnProp =	Expected Averted Onsite Property Costs (cleanup and decontamination, replacement power)
OnDose=	Expected Averted Onsite Occupational Dose Costs
TotalCost=	Expected Total Averted Costs
%lic. ren =	percentage of plants seeking license renewal

Table 1. Results for the 25 plant aggregate

Results for 7% discount rate
Average over aggregate of Core Damage Freq= 8.84E-05 per year
Aggregate Benefits summed over all plant types

t	OffHealth	OffProp	OnProp	OnDose	TotalCost
11	6.69e+06	1.00e+06	2.24e+07	4.86e+05	3.05e+07
16	8.39e+06	1.26e+06	3.34e+07	6.10e+05	4.37e+07
21	9.59e+06	1.44e+06	4.44e+07	6.97e+05	5.61e+07
26	1.04e+07	1.57e+06	5.42e+07	7.58e+05	6.69e+07
31	1.10e+07	1.66e+06	6.23e+07	8.02e+05	7.58e+07

Results for 3% discount rate
Average over aggregate of Core Damage Freq= 8.84E-05 per year
Aggregate Benefits summed over all plant types

t	OffHealth	OffProp	OnProp	OnDose	TotalCost
11	9.21e+06	1.38e+06	3.17e+07	7.79e+05	4.31e+07
16	1.25e+07	1.87e+06	4.71e+07	1.06e+06	6.26e+07
21	1.53e+07	2.30e+06	6.49e+07	1.30e+06	8.38e+07
26	1.78e+07	2.66e+06	8.52e+07	1.50e+06	1.07e+08
31	1.98e+07	2.98e+06	1.08e+08	1.68e+06	1.32e+08

Total Averted Costs as a function of percentage of plants seeking license renewal

	Total Averted Costs	
% lic. ren.	7% discount rate	3% discount rate
50	5.31e+07	8.76e+07
55	5.54e+07	9.21e+07
60	5.77e+07	9.66e+07
65	5.99e+07	1.01e+08
70	6.22e+07	1.05e+08
75	6.45e+07	1.10e+08
80	6.67e+07	1.14e+08
85	6.90e+07	1.19e+08
90	7.12e+07	1.23e+08
95	7.35e+07	1.28e+08
100	7.58e+07	1.32e+08

Table 2. Results for 31 plant aggregate

Results for 7% discount rate
Average over aggregate of Core Damage Freq= 8.65E-05 per year
Aggregate Benefits summed over all plant types

t	OffHealth	OffProp	OnProp	OnDose	TotalCost
11	8.12e+06	1.22e+06	2.71e+07	5.90e+05	3.71e+07
16	1.02e+07	1.53e+06	4.06e+07	7.40e+05	5.31e+07
21	1.16e+07	1.75e+06	5.39e+07	8.46e+05	6.81e+07
26	1.27e+07	1.90e+06	6.58e+07	9.21e+05	8.13e+07
31	1.34e+07	2.01e+06	7.56e+07	9.73e+05	9.20e+07

Results for 3% discount rate
Average over aggregate of Core Damage Freq= 8.65E-05 per year
Aggregate Benefits summed over all plant types

t	OffHealth	OffProp	OnProp	OnDose	TotalCost
11	1.12e+07	1.68e+06	3.85e+07	9.46e+05	5.23e+07
16	1.52e+07	2.28e+06	5.72e+07	1.28e+06	7.59e+07
21	1.86e+07	2.79e+06	7.88e+07	1.57e+06	1.02e+08
26	2.15e+07	3.23e+06	1.03e+08	1.82e+06	1.30e+08
31	2.41e+07	3.61e+06	1.31e+08	2.04e+06	1.60e+08

Total Averted Costs as a function of percentage of plants seeking license renewal

	Total Averted Costs	
% lic. ren.	7% discount rate	3% discount rate
50	6.45e+07	1.06e+08
55	6.73e+07	1.12e+08
60	7.00e+07	1.17e+08
65	7.28e+07	1.23e+08
70	7.55e+07	1.28e+08
75	7.83e+07	1.33e+08
80	8.10e+07	1.39e+08
85	8.37e+07	1.44e+08
90	8.65e+07	1.50e+08
95	8.92e+07	1.55e+08
100	9.20e+07	1.60e+08

Table 3. Results for 37 plant aggregate

7% discount rate
Average over aggregate of Core Damage Freq= 7.78E-05 per year
Aggregate Benefits summed over all plant types

t	OffHealth	OffProp	OnProp	OnDose	TotalCost
11	8.71e+06	1.31e+06	2.91e+07	6.33e+05	3.97e+07
16	1.09e+07	1.64e+06	4.35e+07	7.94e+05	5.69e+07
21	1.25e+07	1.87e+06	5.78e+07	9.07e+05	7.31e+07
26	1.36e+07	2.04e+06	7.05e+07	9.87e+05	8.71e+07
31	1.44e+07	2.16e+06	8.11e+07	1.04e+06	9.86e+07

3% discount rate
Average over aggregate of Core Damage Freq= 7.78E-05 per year
Aggregate Benefits summed over all plant types

t	OffHealth	OffProp	OnProp	OnDose	TotalCost
11	1.20e+07	1.80e+06	4.13e+07	1.01e+06	5.61e+07
16	1.63e+07	2.44e+06	6.14e+07	1.38e+06	8.14e+07
21	1.99e+07	2.99e+06	8.45e+07	1.69e+06	1.09e+08
26	2.31e+07	3.47e+06	1.11e+08	1.95e+06	1.39e+08
31	2.58e+07	3.88e+06	1.40e+08	2.18e+06	1.72e+08

Total Averted Costs as a function of percentage of plants seeking license renewal

	Total Averted Cost	
% lic ren.	7% discount rate	3% discount rate
50	6.92e+07	1.14e+08
55	7.21e+07	1.20e+08
60	7.51e+07	1.26e+08
65	7.80e+07	1.31e+08
70	8.10e+07	1.37e+08
75	8.39e+07	1.43e+08
80	8.69e+07	1.49e+08
85	8.98e+07	1.55e+08
90	9.27e+07	1.60e+08
95	9.57e+07	1.66e+08
100	9.86e+07	1.72e+08